

REMARKS

Favorable reconsideration is respectfully requested.

The claims are 9 to 11 and 13 to 18.

The above amendment is responsive to points set forth in the Official Action.

In this regard, claim 9 has been amended by including the feature of claim 12.

New claim 18 is presented and is supported by the disclosure of paragraph [0041] and [0042].

The significance of the above amendments will become further apparent from the remarks below.

Claims 9 to 10 and 13 to 16 have been rejected under 35 U.S.C. 102(e) as being anticipated by Weber et al. (U.S. 2005/0260522).

This rejection is respectfully traversed.

Firstly, the feature of non-rejected claim 12 has been incorporated in claim 9. Therefore, the above rejection is inapplicable against the present claims which include the feature of claim 12.

Claim 12 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Weber et al. (U.S. 2005/0260522) in view of Kamabuchi et al. (U.S. 2003/0148211).

This rejection is also respectfully traversed.

Weber, at best, is entitled to the benefit of its provisional date of February 13, 2004.

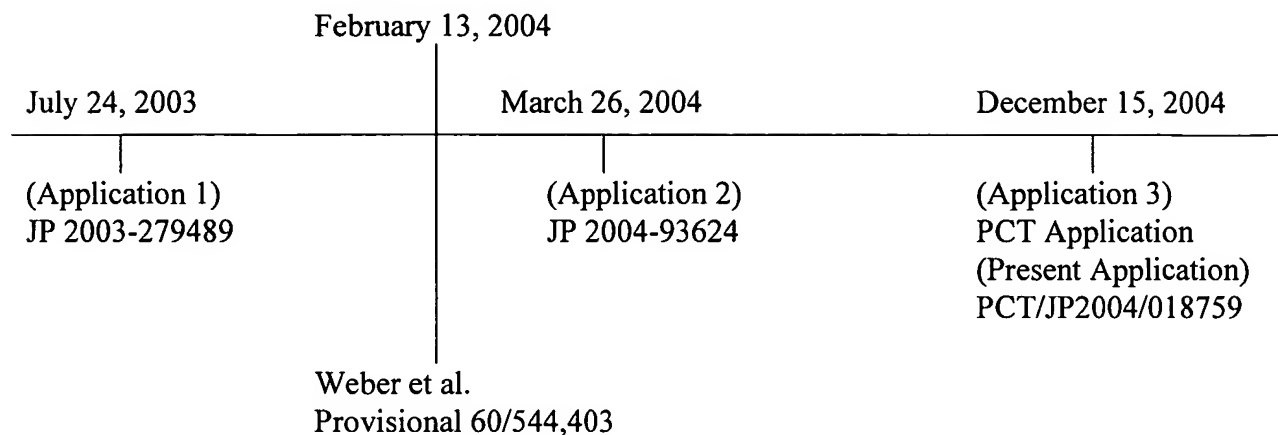
However, the present invention was completed prior to February 13, 2004, i.e. before the filing date of the provisional application of Weber et al.

Turning to the chart below:

- Application 3 (the present application) was filed in Japanese Patent Office, as a PCT application, on December 15, 2004, claiming the benefit of the priority date of Application 2, filed on March 26, 2004.

- Application 2 was filed with the Japanese Patent Office, claiming the benefit of the domestic priority date of Application 1 (Japanese Unexamined Patent Application Publication No. 2003-279489), filed July 24, 2003.

The application history is as follows:



Provisional Application

The invention recited in claims 9 and 12 of the present application is supported by the disclosure of Application 1, as stated below (please find attached a certified copy of Application 1 and an English translation thereof).

The present invention is a photosensitive resin composition, comprising a multi-functional bisphenol A novolac epoxy resin, a functionality of which is 5-functional groups or more and represented by general formula (3), a cation polymerization initiator represented by general formula (1), and a naphthol sensitizer.

Application 1 discloses a photosensitive resin composition comprising a multi-functional epoxy resin, a cation polymerization initiator which can be represented by general formula (1) of the present application, and a naphthol sensitizer.

When the invention of Application 1 is compared to the invention of the present application, it is apparent that both inventions have a common feature, namely the inclusion of a cation polymerization initiator and a naphthol sensitizer.

Additionally, Application 1 discloses a multi-functional bisphenol A novolac epoxy resin, a functionality of which is 5-functional groups or more, as discussed below, and which can be represented by general formula (3) of the present application.

In the present application, EPICOAT 157S70 is disclosed as an example of a multi-functional bisphenol A novolac epoxy resin, a functionality of which is 8-functional groups, represented by general formula (3) (paragraphs [0023] and [0025] in the present application).

Application 1 discloses EPICOAT 157S70 as an example of a multi-functional bisphenol A epoxy resin, a functionality of which is 8-functional groups, which can be represented by general formula (3) of the present application (paragraphs [0019] and [0021] in Application 1).

The present application discloses a multi-functional bisphenol A novolac epoxy resin, a functionality of which is 8-functional groups, and similarly in Application 1, a multi-functional bisphenol A epoxy resin, the functionality of which is 8-functional groups, is disclosed namely the same compound.

As described above in Application 1, a bisphenol A epoxy novolac resin is disclosed as an example of a multi-functional epoxy resin. Furthermore, the functionality is disclosed as, "... functionality having 5-functional groups or more is preferable. In particular, 8-functional bisphenol A epoxy resin (product name: 'EPICOAT 157S70', supplied from Japan Epoxy Resin Co., Ltd.) is preferable". See paragraph [0021] in Application 1. Accordingly, it can be stated that Application 1 discloses a multi-functional bisphenol A novolac epoxy resin, a functionality of which is 5-functional groups or more, which can be represented by general formula (3) of Application 1.

The above facts can be presented by a Declaration under 37 CFR 1.131 which will show an actual reduction to practice as evidenced by Application 1 or conception of the invention prior to the effective date of the reference coupled with diligence from a period of time prior to the reference date of February 23, 2004 until Applicants' Japanese priority date (Application 2) on March 26, 2004.

Even if Weber is not antedated, the present invention is not obvious even when combining the teachings of Weber et al. and Kamabuchi et al.

The present invention discloses a photosensitive resin composition having high sensitivity, which allows for the formation of patterns having low shrinkage in volume during a heat-setting process and high aspect ratio profile, by combining a multi-functional bisphenol A novolac epoxy

resin, the functionality of which is 5-functional groups or more, and a cation polymerization initiator represented by general formula (1) (paragraphs [0010] to [0012]).

The present invention relates to a mixture of the bisphenol A novolac epoxy resin and a cationic polymer initiator, the high sensitivity of which makes the dimensions of resulting resin patterns thicker than those of a mask when a radiation beam is irradiated with a space between them. Such an increase in thickness may be controlled without loss of sensitivity by including a naphthol sensitizer (paragraphs [0044] to [0046]), as now recited in claim 9.

The effect of naphthol has been established in Examples 1 and 2 of the present application, as follows: in Example 2, where naphthol is employed, the wire width was 7 μm , whereas in Example 1, where naphthol is not employed, the wire width was 8 μm (the ratio of the wire width of Example 1 to Example 2 is $8/7=1.14$).

Thus, the addition of 1-naphthol sensitizer reduces the line widths of the mask and permits an increase in thickness of the resist without loss of sensitivity.

According to the teachings of Weber et al., a sensitizer such as naphthalene is disclosed (paragraph [0009]), however, nothing is disclosed regarding naphthol, an alcohol, as disclosed by the present application. With regard to the sensitizer, Weber et al. discloses nothing other than the co-use of a photoacid generator.

Furthermore, nothing is disclosed or even implied concerning the use of naphthol to control the increase in thickness obtained by combining the novolac epoxy resin and the cation polymer initiator, as disclosed in the present invention.

Kamabuchi et al. discloses the use of a specific sulfonium salt in a chemical amplifying type positive resist composition having sensitivity in good balance with a component in a resist pattern. In Kamabuchi et al., a polymer of carboxylic ester is used as a resin component in a resist composition. Many of sensitizers are enumerated in Kamabuchi et al. and 1-naphthol is exemplified as one of them. However, the sensitizers used in Kamabuchi et al. serve a primary role to promote photoreactions. Furthermore, nothing is disclosed or even implied in Kamabuchi et al. concerning the use of naphthol to control an increase in thickness obtained by combining the novolac epoxy resin and the cationic polymer initiator, as disclosed in the present invention.

The cited prior art discloses that a sensitizer can be added to a photosensitive composition, but does not go beyond disclosing that it can be added as an adjuvant for increasing the photosensitivity and there is no disclosure or suggestion that the above-specified effects can be obtained by adding a naphthol type sensitizer to a combination of a specified epoxy resin and a specified cation photopolymerization initiator. Accordingly, above amended claim 9 and claims dependent thereon are not obvious from the prior art.

Claims 9, 13, 15 and 17 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Hurditch et al. (U.S. 6,391,523) in view of Okawa et al. (JP 9-268205).

This rejection is also respectfully traversed.

The present invention relates to a photosensitive resin composition which makes possible the formation of 10 μm order of refined resin pattern using photolithography techniques. The photosensitive resin composition of the present invention is a combination of the multi-functional bisphenol A novolac epoxy resin with 5 or more functional groups shown in Formula (3) of the present application, and the cationic polymerization initiator shown in Formula (1).

The photosensitive resin composition of the present invention can form a resin pattern having (a) high sensitivity, with (b) low volumetric shrinkage when heat curing, and (c) a high aspect profile.

Hurditch et al. discloses a combination of a multi-functional bisphenol A novolac epoxy resin with 5 or more functional groups, and a triaryl sulfonium salt, and Okawa et al. discloses that it is possible to obtain a resin composition with high sensitivity and low shrinkage when curing, by combining the polymerization initiator of the present invention and a glycidyl ether of bisphenol A.

However, Hurditch et al. and Okawa et al., apart from above points (a) and (b), have no disclosure or suggestion concerning a means for obtaining the above point (c), a resin pattern having a high aspect profile.

Furthermore, Hurditch et al. does not disclose the use of a sensitizer, and Okawa et al. does not go beyond disclosing that a sensitizer may be used if necessary. Accordingly, the present claims are not obvious based on the combination of Hurditch et al. and Okawa et al.

Claim 11 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Hurditch et al. (U.S. 6,391,523) in view of Okawa et al. (JP 9-268205) as applied to claim 9 above and in further view of Umeyama et al. (JP 11-323094).

This rejection is also respectfully traversed.

Hurditch and Okawa are discussed above.

Umeyama et al. discloses the use of the epoxy resin shown in Formula (1) instead of the bisphenol A type epoxy resin, along with the cationic polymerization initiator shown in Formula (3), in order to improve the storage stability and the film smoothness of a bisphenol A type epoxy resin used in a solid epoxy resin composition cured by photocationic polymerization.

Umeyama et al. further discloses the combined use of the epoxy resin shown in Figure (1) and a multi-functional resin, novolac resin or the like which is a glycidyl ether compound of a phenol such as a bisphenol A used in the prior art.


Accordingly, Umeyama et al. relates to the use of the epoxy resin shown in Formula (1) as an epoxy resin which is to be the main component, in a solid epoxy resin composition. In contrast, the present invention relates to the use of the epoxy resin recited in claim 11 or 18 for improving the coat forming properties of a composition, using a bisphenol A type novolac epoxy resin having 5 or more functional groups disclosed in Formula (3) of the present specification, as an epoxy resin to form the main component. While, Umeyama et al. discloses anthracene, anthracene derivatives and perylene as the sensitizing agent, it does not disclose or suggest the use of a naphthol type sensitizing agent or its effects, and therefore, the present invention is not obvious from the combination of Hurditch et al., Okawa et al. and Umeyama et al.

No further issues remaining, allowance of this application is respectfully requested.

If the Examiner has any comments or proposals for expediting prosecution, please contact undersigned at the telephone number below.

Respectfully submitted,

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